DAY

# Navigation: Pacing and Measuring Distance

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# **STEM CONNECTIONS**

Technology: Knowledge Construction

Math: Ratios & Proportional Reasoning



# DURATION

60 Minute Lesson



# MATERIALS

- Page pockets (1 per tribe) holding:
  - Ranger Bead Directions
- Dry erase marker (1 per tribe)
- Already in Survival Kits:
  - Paracord (10 ft length per student)
- Pony beads (13 beads per student)

# SCHEDULE

- Survivor Mail (5 min)
- Ranger Beads (35 min)
- Walk This Way Survivor Challenge (10 min)
- Wrap Up (10 min)

### **OBJECTIVE**

Count paces and use ranger beads while learning to measure distance traveled!

### **ALIGNED STANDARDS**

- CCSS.MATH.CONTENT.6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
- CCSS.MATH.CONTENT.6.RP.A.3.D Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
- ISTE-S.3.d Students build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.

### **21ST CENTURY SKILLS**

- Productivity and Accountability
- Information, Media and Technology Literacy
- Initiative and Self-Direction

# HABITS OF MIND

- Striving for Accuracy
- Remaining Open to Continuous Learning

#### **KEY TERMS**

**Odometer**: a tool for measuring distance traveled.

# **BACKGROUND INFORMATION**

In today's hyper precise world, the standards of measurement have come a long way. In the old world, you measured by the size of your body — an average horse being around 15 hands tall. Now, with the help of laser measurements and universal scales, these times of rough estimation are far behind us. This is particularly true of maps. Since the invention of GPS systems, backcountry navigation has been revolutionized, providing real-time data to any explorer. Now, if you catch yourself in a survival situation without the help of technology, ranger beads are a simple, low-tech alternative for measuring distance. Originally, they were developed by the armed forces, and today they continue to be used by the military, outdoor recreationists and people who compete in orienteering races.

Ranger beads can be easily made with two sets of pony beads on a piece of knotted paracord. The bottom pony beads each represent 100m, the top representing full kilometers. As you travel, move the lower 100m beads one by one, pulling down a top bead when you reach a full kilometer. Then, reset the lower beads to keep going. With four upper beads, one set of ranger



beads can measure up to 4k, or about 2.5 miles. Working with a little less space? No problem. The Ranger Bead Instructions are scaled down by ten so the lower beads each represent 10m and the upper beads 100m. With the same four upper beads, this system can track up to 400m, which is about 0.25 miles or one lap around a track.

Measuring distance is an important part of survival. You need to be able to know where you're going, how far you've gone and if you know the amount of traveling you still need to do, how far you still need to travel. It's also a helpful way to keep track of the amount of effort you are exerting. It might not feel like it, but traveling a full two miles on a limited diet can be enough to sideline you and your survival efforts. Be cautious, and make sure to take everything in stride!

# DAILY PREP

Day 6 introduces campers to navigation by teaching them to estimate their pace count, using ranger beads to keep track of paces! At the end of the day, each tribe has a chance to test their new skills in the fun Survivor Challenge.

- Review the Background Information and lesson.
- Prep Ranger Bead Instructions in page pockets.
- Find a large open area so campers have lots of room to move around.
- Measure out 10 meters for the Ranger Beads activity, designating the beginning and the end. Normally, pace count is measured over a course of 100 meters and pace beads keep track of kilometers. But due to time and space constraints, pace count is estimated over 10 meters. If you have access to a distance of 100m, the directions can easily be adapted to give campers a more realistic measure of their pace count.



# **DAY 6:** Navigation: Pacing and Measuring Distance

# STEP-BY-STEP DIRECTIONS FOR INSTRUCTORS



# **SURVIVOR MAIL**

Welcome campers back to camp and read today's Survivor Mail. As you work through each activity, share details with survivors from the Background Information.



Greetings, castaways! As Survivors, you don't have the luxury of relying on devices like phones or GPS trackers. Without technology, how will you keep track of the distance you've traveled? With attention to detail, creative engineering and a quick lesson from army rangers, you'll be ready to take on the first navigation Survivor challenge.



# **RANGER BEADS**

Introduce ranger beads to the group:

 How could you keep track of distance without an odometer, GPS or other smart technology? (Encourage lots of creative answers. One solution is ranger beads. This low-tech system is a very basic odometer built with paracord and pony beads that helps estimate the distance traveled by foot. The beads help keep track of the number of steps you have taken. Ranger beads were originally developed by the armed forces and continue to be used by the military, outdoor recreationists and people who compete in races that require orienteering.)

Hand out a page pocket holding the Ranger Bead Instructions to each group. Either work through the instructions all together or have each tribe collaborate independently.

- As campers make their ranger beads, one extra challenge is to figure out how to make it work using the long pieces of paracord in their Survival Kits, just like they'd need to do in a real survival scenario.
- Campers may wonder why they're using meters instead of feet. The answer is two-fold. First, the math is much simpler in meters since everything is in 10's. Second, the metric system is more universal. Most of the world, as well as most maps, use the metric system, so it pays off to join the club.



# WALK THIS WAY SURVIVOR CHALLENGE

After campers have had at least 5 minutes to practice measuring distances with the ranger beads, gather together. Have each tribe stand in a circle with their backs together. Make sure the different tribes are spread out as far as possible.

Introduce the challenge to your tribes, then call out directions:

Alright tribes, this is your chance to show off your pacing and navigation skills. Hold on to your ranger beads, look out for each other and listen carefully to these navigation instructions.

- Walk straight ahead for 10 meters. Stop.
- Turn 90 degrees to your right.
- Walk straight ahead for 20 meters. Stop.
- Turn 90 degrees to your right.
- Walk straight ahead for 10 meters. Stop.
- Turn 90 degrees to your right.
- Walk straight ahead for 20 meters. Stop.

Each tribe should end up exactly where they started. The tribe that navigated the most accurately is the winner!

# **Group Discussion**

# WRAP UP

Store Survival Kits and gather together to wrap up the day. Campers break-out their ranger beads again later in camp, so keep them assembled as part of the Survival Kits.

- Why is pace counting important? What other tools could be used with ranger beads? (Maps and compasses.)
- What can affect pacing? (Terrain, weather, what you are carrying, running.)
- Does everyone have the same pace count? Why or why not? (People have different length of legs and feet, and walk differently.)
- How else can the ranger beads be used? (To keep track of anything.)
- No beads? No problem. If you don't have beads what else could be used to keep track of distance? (Rocks is one example. Place small rocks or pebbles in one pocket. Every 10 meters, move a pebble to your other pocket. Use a larger rocks to keep track of increments of 100 meters.)

# CHECK FOR UNDERSTANDING

- What would your pacing beads look like after traveling 250 meters? (2 of the upper and 5 of the lower beads would be moved.)
- How could you change your pacing bead system to travel longer distances? (Change how many meters each bead represents and scale up the pace count to adjust. If you used 5 paces for 10m, count to 50 to go 100m.)
- Why are most pacing beads calibrated in meters and kilometers instead of feet and inches? (The metric is base ten, so it's easy to adjust the measurements. Most of the world and most maps also use kilometers.)

# **EXTENSIONS: PACING**

The number of paces can vary depending on the terrain, the weather, day or night, what you are carrying and whether you are walking or running. How much does the terrain affect your pace count?

Find a hill or a different type of groundcover, such as sand or thick vegetation. Measure off 10 meters. Count your paces in each direction and take the average of the two. Was it the same as on flat ground? Probably not. Anytime you add in difficulty, your pace count will most likely increase.

Now run 10 meters and count your paces. Did they increase or decrease from walking over flat ground? What if you carried something heavy like a backpack? This typically decreases the number of paces you have to take to cover 10 meters.

Some people remember each of the these numbers, and some take the overall average. But what is important to know is a number of different variables can change your pace count and you have to keep that in mind when you are estimating the distance you have or have to travel.

# **SURVIVOR MATH:**

This math extension fits well before the *Survivor Camp* Challenge. Challenge groups who finish early, or have the whole group dive in together.

How far did you walk? Can you convert that into feet and miles? 1 meter is equal to 3.28 feet. To make the math easier, round to 3.3 feet. Remember, each pony bead on the bottom is 10 meters, and each one on top is 100 meters.

If there are 5280 feet in a mile, estimate how far you walked. Did you walk greater or less than one-tenth of a mile?

Did anyone move all 4 of their top beads? How far is this in miles? (400 meters is equal to .25 miles, which is one lap around the track.)